Usage Considerations of Java StampedLock

Douglas C. Schmidt
d.schmidt@vanderbilt.edu
www.dre.vanderbilt.edu/~schmidt

Institute for Software Integrated Systems
Vanderbilt University
Nashville, Tennessee, USA
Learning Objectives in this Part of the Lesson

• Understand the structure, functionality of the Java StampedLock class
• Know the key methods in Java StampedLock
• Recognize how to apply Java StampedLock in practice
• Appreciate Java StampedLock usage considerations

We’ll also compare/contrast StampedLock with other Java synchronizers
Java StampedLock
Usage Considerations
Java StampedLock Usage Conventions

- StampedLock often *much* faster than ReentrantReadWriteLock

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19 readers & 1 writer

*Optimistic read mode works very well with little/no contention*

Java StampedLock Usage Conventions

- StampedLock often *much* faster than ReentrantReadWriteLock

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19 readers & 1 writer

*ReentrantReadWriteLock is very slow.*

Java StampedLock Usage Conventions

- StampedLock often *much* faster than ReentrantReadWriteLock

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19 readers & 1 writer

*StampedLock with “reading mode” works better than ReentrantReadWriteLock*

Java StampedLock Usage Conventions

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*Synchronized statements perform quite well*

Java StampedLock Usage Conventions

- StampedLock often *much* faster than ReentrantReadWriteLock

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**EPA Fuel Economy Estimates**

These estimates reflect new EPA methods beginning with 2008 models.

**CITY MPG**

18

Expected range for most drivers
15 to 21 MPG

**HIGHWAY MPG**

25

Expected range for most drivers
21 to 29 MPG

**Estimated Annual Fuel Cost**

$2,039

Based on 15,000 miles at $2.80 per gallon

**Combined Fuel Economy**

This Vehicle

21

10

31

All SUVs

See the FREE Fuel Economy Guide at dealers or www.fueleconomy.gov

*However, your mileage may vary!*

See [en.wiktionary.org/wiki/your_mileage_may_vary](en.wiktionary.org/wiki/your_mileage_may_vary)
### Java StampedLock Usage Conventions

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**10 readers & 10 writers**

*Optimistic read mode works less well with more contention*

# Java StampedLock Usage Conventions

- StampedLock often *much* faster than ReentrantReadWriteLock

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10 readers & 10 writers

*However, ReentrantReadWriteLock is still much slower.*

## Java StampedLock Usage Conventions

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- **10 readers & 10 writers**

  *StampedLock & synchronized statements both do quite well*

Java StampedLock Usage Conventions

- Java StampedLock speedups are only fully realized under certain conditions
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- Java StampedLock speedups are only fully realized under certain conditions, e.g.
  - Frequency of reads to writes
    - Ideally, *many* more reads than writes
Java StampedLock Usage Conventions

- Java StampedLock speedups are only fully realized under certain conditions, e.g.
  - Frequency of reads to writes
  - Duration of read & write operations
    - Ideally, read operations should be non-trivial or else locking costs may dominate
Java StampedLock Usage Conventions

- Java StampedLock speedups are only fully realized under certain conditions, e.g.
  - Frequency of reads to writes
  - Duration of read & write operations
  - “Contention” for the data
  - Ideally, *many* concurrent readers
Java StampedLock Usage Conventions

- Java StampedLock speedups are only fully realized under certain conditions, e.g.
  - Frequency of reads to writes
  - Duration of read & write operations
  - “Contention” for the data
  - Number of processor cores
    - Ideally, many cores
Java StampedLock Usage Conventions

- StampedLock can be harder to use than ReentrantReadWriteLock
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- Many more methods
Java StampedLock Usage Conventions

- StampedLock can be harder to use than ReentrantReadWriteLock
  - Many more methods
  - More intricate semantics & usage patterns

```java
void moveIfAtOrigin(double newX, double newY) {
    long stamp = sl.readLock();
    try {
        while (x == 0.0 && y == 0.0) {
            long ws =
                sl.tryConvertToWriteLock(stamp);
            if (ws != 0L) {
                stamp = ws;
                x = newX; y = newY;
                break;
            } else {
                sl.unlockRead(stamp);
                stamp = sl.writeLock();
            }
        }
    } finally {
        sl.unlock(stamp);
    }
    ...
```
Java StampedLock Usage Conventions

- StampedLock can be harder to use than ReentrantReadWriteLock
  - Many more methods
  - More intricate semantics & usage patterns
  - Invariants are tricky with optimistic read locks

```java
class Boooom {
    StampedLock mS =
        new StampedLock();
    int mX = 0;
    int mY = 1;
    ...

    // Thread T1
    while (true) {
        mS.writeLock();
        mX++;
        mY++;
        mS.writeUnlock();
    }

    // Thread T2
    do {  
        stamp = mS.tryOptimisticRead();
        z = 1 / (mX - mY);
    } while (mS.validate(stamp));
}
```

See [concurrencyfreaks.blogspot.com/2013/11/stampedlocktryoptimisticread-and.html](http://concurrencyfreaks.blogspot.com/2013/11/stampedlocktryoptimisticread-and.html)
Java StampedLock Usage Conventions

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}
```

Create a StampedLock to protect two fields
Java StampedLock Usage Conventions

- StampedLock can be harder to use than ReentrantReadWriteLock
  - Many more methods
  - More intricate semantics & usage patterns
  - Invariants are tricky with optimistic read locks
  - Fields read in optimistic mode may be inconsistent since their values can change unpredictably

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class Boooom {
    StampedLock mS = new StampedLock();
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    // Thread T1
    while (true) {
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    }

    // Thread T2
    do {
        stamp = mS.tryOptimisticRead();
        z = 1 / (mX - mY);
    } while (mS.validate(stamp));
}
```

Want to establish the invariant \( mX = mY - 1 \)
Java StampedLock Usage Conventions

- StampedLock can be harder to use than ReentrantReadWriteLock
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```java
class Boooom {
    StampedLock mS =
        new StampedLock();
    int mX = 0;
    int mY = 1;

    ...  

    // Thread T1
    while (true) {
        mS.writeLock();
        mX++;
        mY++;
        mS.writeUnlock();
    }

    // Thread T2
    do {
        stamp = mS.tryOptimisticRead();
        z = 1 / (mX - mY);
    } while (mS.validate(stamp));
}
```

*Since no read lock is held, mX & mY may be reordered, such that invariant mX == mY – 1 may not hold*

See concurrencyfreaks.blogspot.com/2013/11/stampedlocktryoptimisticread-and.html
Java StampedLock Usage Conventions

- StampedLock can be harder to use than ReentrantReadWriteLock
  - Many more methods
  - More intricate semantics & usage patterns
  - Invariants are tricky with optimistic read locks
- Non-reentrant
Java StampedLock Usage Conventions

- StampedLock is usually the best choice for readers-writer locks in Java 8+!

- Despite its complexity & lack of reentrant semantics

End of Usage Considerations of Java StampedLock